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13. ABSTRACT *(Maximum 200 words)*

The present grant was an instrumentation grant. Its purpose to provide funds to acquire instrumentation supportive of research work in the areas of time-domain optical storage, processing, and routing technologies. The complete catalog of instrumentation items requested or currently available equivalents have been ordered, received, and incorporated into ongoing research supported under AFOSR grants F49620-95-1-0465 and F49620-96-1-0259.

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Final Technical Report
Instrumentation for the Development of Time-Domain Optical Storage, Processing, and Routing Technologies
1 September 1995 through 31 December 1996
F49620-95-1-0493

Project Title:	Instrumentation for the Development of Time-Domain Optical Storage, Processing, and Routing Technologies
Principal Investigator:	Thomas W. Mossberg Professor of Physics University of Oregon Eugene, Oregon 97403 Phone: 541-346-4779 Fax: 541-346-4791 email: twmoss@oregon.uoregon.edu
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Grant Number:	F49620-95-1-0493
Reporting Period:	September 1, 1995 - December 31, 1996

Report

Objectives:

Unchanged from original proposal

Time-domain Frequency-selective Optical Data Storage and Processing techniques are relatively new and therefore largely unknown to many workers in the fields of optical communications, computing, and storage. Nevertheless, these techniques have unique capabilities that may facilitate the development of entirely new classes of ultra-high-speed optical communication, routing, storage, and processing devices that provide performance substantially beyond the current state-of-the-art. For example, memories involving time-domain frequency-selective techniques promise multi-GHz bandwidth and near atomic level storage densities far beyond storage densities available using current optical or magnetic technologies. Areal storage densities more than an order of magnitude larger than the current optical state-of-the-art have recently been demonstrated in preliminary Time-Domain optical memory studies. Generally speaking, experimental studies of Time-Domain Frequency-Selective Storage and Processing techniques has been seriously constrained by available facilities. To clearly demonstrate the capabilities of Time-Domain techniques, one needs lasers of precisely controlled amplitude, frequency, and phase. The external-cavity diode lasers, phase modulator, lock-in amplifier, wavemeter, and Fabry-Perot interferometer requested here provide laser, laser stabilization, and laser diagnostic capability. To demonstrate the high bandwidth potential of this new class of processes, high-speed laser beam amplitude/phase modulation and high-speed detection capabilities are required. The integrated-optical modulators, waveform generator, transient recorder, and detectors provide these. Finally, to find materials exhibiting favorable coherence lifetimes, spectroscopic measurement equipment is required and is provided by the spectrometer requested. Funding of this equipment proposal will open the door to truly impressive demonstrations of the capabilities offered by Time-Domain Frequency-Selective Memory and Processing schemes and thereby provide the stimulus necessary to spur development of this new field.

Status of Effort:

The present grant was an instrumentation grant. Its stated purpose was to provide funds to acquire instrumentation supportive of research work in the areas of time-domain optical storage, processing, and routing technologies. The complete catalog of instrumentation items requested or currently available equivalents have been ordered, received, and incorporated into ongoing research supported under AFOSR grants F49620-95-1-0465 and F49620-96-1-0259. Since the grant period provided only enough time to acquire and incorporate equipment into new and existing projects supported under the grants just specified, new detailed technical results are not yet available. They will be

reported in the regularly scheduled technical reports for grants F49620-95-1-0465 and F49620-96-1-0259.

Accomplishments/New Findings:

As indicated in the preceding paragraph, the funding period for this instrumentation grant was only long enough to acquire the specified items. Technical results derived from ongoing use of the instrumentation will be conveyed through the standard technical reports specified for AFOSR research grants F49620-95-1-0465 and F49620-96-1-0259.

Personnel Supported by the grant:

Personnel support not allowed under instrumentation grant guidelines

Publications:

Demonstration of 8 Gbit/in2 areal storage density using swept-carrier frequency-selective optical memory, H. Lin, T. Wang, and T. W.
Mossberg, Opt. Lett. 20, 1658 (1995).

Optical Bit Rate Conversion and Bit Stream Time-Reversal Using Swept-Carrier Frequency-Selective Optical Data Storage Techniques,
T. Wang, H. Lin, and T. W. Mossberg, Opt. Lett. 20, 2033 (1995).

Experimental Demonstration of Temporal-Waveform-Controlled Spatial Routing of Optical Beams via Spatial-Spectral Filtering, Opt.
Lett. 20, 2541 (1995).

Single-sideband spectral holographic optical memory, H. Lin, T. Wang, and T. W. Mossberg, Opt. Lett. 21, 1866 (1996).

Interactions/Transitions:

a. Conference Presentations:

Contributed:
Demonstration of 8 Gbit/in^2 storage density using swept-carrier frequency-selective optical memory, H. Lin, T. Wang, and T. W. Mossberg, 1995 OSA/ILS Annual meeting,

Sept. 11-16, 1995, Portland, OR.

Optical bit-rate conversion and time-reversal using swept-carrier optical data storage techniques, T. Wang, H. Lin, and T. W. Mossberg, 1995 OSA/ILS Annual meeting, Sept. 11-16, 1995, Portland, OR.

Single-Sideband data retrieval using swept-carrier optical memory, T. Wang, H. Lin, and T. W. Mossberg, CLEO June 2-7, 1996, Anaheim, CA

Experimental demonstration of temporal-waveform-controlled spatial routing of optical beams via spatial-spectral filtering, T. Wang, H. Lin, and T. W. Mossberg, CLEO June 2-7, 1996, Anaheim, CA.

Cavity enhancement of coherent transient signals, T. Wang, H. Lin, and T. W. Mossberg, OSA/ILS 1996 Annual Meeting, Oct. 20-26, 1996, Rochester, NY.

Optical Heterodyne study of frequency-swept, external-cavity, diode laser coherence properties, T. Wang, H. Lin, and T. W. Mossberg, OSA/ILS 1996 Annual Meeting, Oct. 20-26, 1996, Rochester, NY.

Invited:
Air Force Workshop on Persistent Spectral Holeburning, T. W. Mossberg, Big Sky Montana, March 1996.

Persistent Spectral Holeburning and Applications, T. W. Mossberg, Rare-Earth Research Conference, Duluth, MN, July 1996.

Persistent Spectral Holeburning and Applications, T. W. Mossberg, Persistent Spectral Holeburning Conference, Brainerd, MN, Sept. 1996.

Time-Domain Spectral Holographic Memory, T. W. Mossberg, OSA/ILS 1996 Annual Meeting, Oct. 20-26, 1996, Rochester, NY.

Time-Domain Spectral Holographic Memory, T. W. Mossberg, IEEE LEOS Annual Meeting, Nov. 18-21, 1996, Boston, MA.

b. Consultative and advisory functions to other laboratories and agencies: None

c. Transitions: Supported work at the University of Oregon is being performed in

collaboration with researchers at Templex Technology Corporation of Eugene, Oregon. Templex is involved in the commercialization of time-domain frequency-selective memory devices and content-controlled all-optical routers and switches.

New Discoveries:
A new approach to all-optical, content-controlled, optical switching and routing employing frequency-insensitive substrate materials has been proposed.

Honors/Awards:
T. W. Mossberg - appointed Fellow American Physical Society, June 1996

Lifetime:
Fellow Optical Society of America